

## ABSTRACT

A device according to the present invention is provided with element temperature measurement voltage application circuit for temporarily applying a predetermined voltage for element temperature measurement to a sensor element of an air-fuel ratio sensor equipped to an exhaust system of an internal combustion engine, first sensor output reading circuit for reading in a sensor output just before applied with the voltage, and second sensor output reading circuit for reading in a sensor output being applied with the voltage, wherein the element temperature of the air-fuel ratio sensor is estimated based on the sensor output just before applied with the voltage and the sensor output being applied with the voltage. Further, during internal resistance measurement of the sensor element of the air-fuel ratio sensor equipped to the exhaust system of the internal combustion engine, a voltage applied to the heater for heating the sensor element is maintained to be constant.